HOUSATONIC RIVER FLOOD CONTROL

NORTHFIELD BROOK
DAM & RESERVOIR

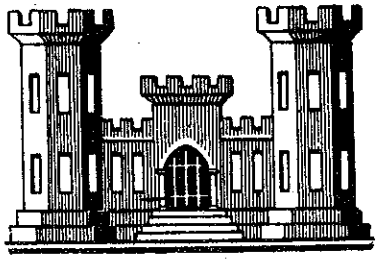
NORTHFIELD BROOK

(LOWER NAUGATUCK RIVER, BELOW THOMASTON)

CONNECTICUT

DESIGN MEMORANDUM NO. 2

SITE GEOLOGY



U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

APRIL 1962

TC423
.N43N874 Northfield Brook Dam and Reservoir,
1962 Northfield Brook (Lower Naugatuck River, below Thomaston), Connecticut: design memorandum no. 2: site geology. -- Waltham, Mass. : U.S. Army Engineer Division, New England, 1962.
8 p., 10 plates : ill., maps ; 28 cm. -- (Housatonic River flood control.) (Design memorandum no. 2: site geology.)
"April 1962"

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TC423
.N43N874 Northfield Brook Dam and Reservoir,
1962 Northfield Brook (Lower Naugatuck River, below Thomaston), Connecticut: ... 1962. (Card 2)
1. Flood control--Connecticut--Northfield Brook. 2. Flood dams and reservoirs--Connecticut--Northfield Brook. 3. Northfield Brook Dam (Conn.) --Flood control. 4. Northfield Brook Reservoir (Conn.)--Flood control. 5. Naugatuck River watershed (Conn.)--Flood control. 6. Housatonic River watershed (Conn.)--Flood control. I. United States. Army. Corps of Engineers. New England Division. II. Series III. Series: Design memorandum no . 2: site geology.

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

NEDGW

12 April 1962

SUBJECT: Northfield Brook Dam and Reservoir - Northfield Brook - Housatonic River Basin, Connecticut - Design Memorandum No. 2 - Site Geology

TO: Chief of Engineers
ATTN: ENGCW-E
Department of the Army
Washington, D. C.

There is submitted for review and approval Design Memorandum No. 2 - Site Geology for the Northfield Dam and Reservoir - Northfield Brook - Housatonic River Basin, Connecticut, in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

John Wm. Leslie

1 Incl. (10 cys)
Design Memo No. 2

JOHN WM. LESLIE
Chief, Engineering Division

FLOOD CONTROL PROJECT

NORTHFIELD BROOK DAM AND RESERVOIR

NORTHFIELD BROOK

HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDA INDEX

Number	Title	Submission Date	Approved
1	Hydrology & Hydraulics Analysis		
2	Site Geology	12 Apr 1962	
3	General Design		
4	Relocations		
5	Concrete Materials	21 Nov 1961	7 Dec 1961
6	Real Estate		
7	Embankments and Foundation		
8	Detailed Design of Structures		
9	Reservoir Management		

NORTHFIELD BROOK DAM AND RESERVOIR
NORTHFIELD BROOK
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 2

SITE GEOLOGY

CONTENTS

LIST OF FIGURES AND PLATES

FIGURES

LIST OF PLATES

NORTHFIELD BROOK DAM AND RESERVOIR

SITE GEOLOGY

APRIL 1962

A. GENERAL TOPOGRAPHY AND GEOLOGY

1. The Northfield Brook dam site is located on Northfield Brook approximately one mile upstream from the junction of the brook with the Naugatuck River and approximately one mile northwest of Thomaston, Connecticut. Access to the site is available on a good hard-surfaced road.

2. As shown on General Plan, Plate 1-1, the project consists of an earth fill dam approximately 810 feet long with top of dam at Elevation 591 m.s.l. corresponding to a maximum height of 118 feet above the stream channel. A chute type spillway in rock with weir crest at elevation 576 m.s.l. is located high on the left abutment of the dam and an outlet conduit with a drop intake to maintain a shallow permanent pool is located along the valley bottom at the foot of the right abutment. The relocation of the existing highway will be on the west side of the valley above the right abutment of the dam.

3. Northfield Brook flows through the western highlands of Connecticut, a rugged, maturely dissected upland of moderate relief underlain by crystalline rocks. It is a region of rough, irregular ridges and relatively deep, steep-sided valleys. Glaciation has modified the topography by rounding and smoothing the bedrock hills and ridges and blanketing them with a generally thin mantle of till. The valley bottoms usually are deeply filled by till and outwash except where present streams raised by the glacial filling from their old channels, have encountered bedrock spurs on the sides of the old valleys. The bedrock of the region consists mainly of complexly folded schists, gneisses and granitic rocks. The folds trend generally north-south.

B. DESCRIPTION OF SITE.

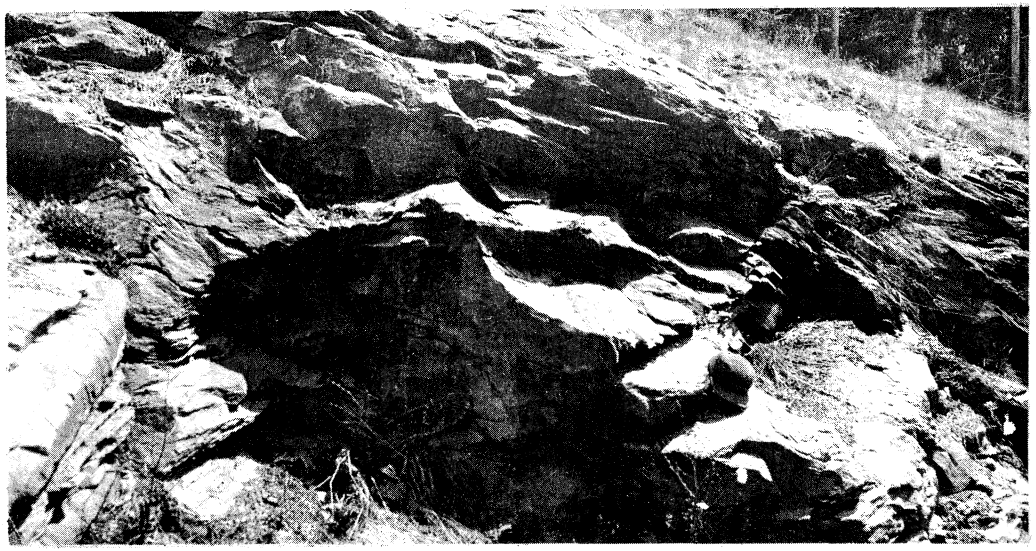
4. At the site, Litchfield Road runs on a low fill along the east side of Northfield Brook. The brook occupies a poorly defined, shallow channel through the flat bottom of a former small pond which existed prior to failure of a small dam located at the downstream end of the proposed conduit discharge channel. Both abutments rise at moderate to steep slopes to heights far above the proposed dam. The lower part of the left abutment is cleared pasture with bedrock showing in scattered outcrops. The upper slope is covered with thin hardwood growth. The right abutment is thickly wooded upstream from the centerline of dam with extensive outcrops occurring along the lower slopes and more scattered outcrops continuing upward to the prominent rock ledges exposed along the power line above the proposed top of dam.

C. SURFICIAL AND SUBSURFACE INVESTIGATIONS.

5. Investigations of survey report scope for the Northfield Brook dam site were made for the Interim Report on Review of Survey, Housatonic River, Naugatuck River Basin, dated 30 June 1958. Subsurface explorations were not undertaken at that stage of the investigations because existing exposures of both overburden and bedrock provided adequate information for preliminary designs and estimates.

6. Design investigations were initiated in May 1961. The previous report was reviewed and detailed mapping of bedrock outcrops at the site was done preparatory to planning subsurface explorations. An initial layout of structures was made and 26 borings, as shown on Plan of Foundation Explorations, Plate 2-2, were completed under contract by Sprague and Henwood, Inc., Scranton, Pa. to investigate foundation conditions. Six test pits were hand excavated largely in lieu of borings in areas where relatively shallow depths to rock were expected. The borings showed that the bedrock surface was below invert grade throughout most of the length of the initial conduit location so the alignment was shifted approximately 40 feet toward the right abutment where bedrock occurs at higher elevations. Because of the originally proposed relocation of Litchfield Road, the spillway in the initial layout was located near the top of the right abutment. Currently, however, the State of Connecticut proposes to relocate Litchfield Road to the west side of the valley above the right abutment of the dam and the location of the spillway has been shifted according to the left abutment. A few additional explorations are in progress as shown on Plan of Exploration, Plate 2-2, to investigate conditions at the intake and outlet structures for the conduit and for the new spillway location.

7. It was recognized because of the general thinness of the till cover in the region and the scarcity of deposits of pervious materials that location of adequate nearby sources of borrow materials for the embankment would be a problem. Early reconnaissance was, therefore, concentrated in locating the most favorable areas for additional detailed exploration. Explorations for impervious material have been made in the area shown on General Plan, Plate 1-1, in and extending high above the reservoir immediately upstream from the left abutment of the dam. As shown on Plan of Borrow Exploration, Plate 2-8, 17 borings have been completed in the area, to determine the thickness of the deposit and the character of material available. Four machine excavated test pits were also completed to permit visual examination of the material in place and to provide large samples of representative materials for laboratory tests. Preliminary estimates based on explorations to date indicate that it may be necessary to explore an extention of the area northward to obtain adequate quantities of required material.



TYPICAL BEDROCK EXPOSED IN HIGHWAY CUT APPROXIMATELY
600 FEET DOWNSTREAM FROM CENTERLINE OF DAM

NORTHFIELD BROOK DAM SITE

FIGURE

8. All borings were drive sampled in overburden and the bedrock was diamond-drill cored using maximum recovery type core barrels generally to a minimum penetration of 20 feet in rock. Hydraulic pressure tests in rock were performed in 13 borings located along the centerline of dam and the initial conduit alignment. Descriptions and detailed classifications of material encountered in all explorations and the results of hydraulic pressure tests in rock are shown in the Records of Exploration, Plates 2-6, 2-7, 2-9 and 2-10.

D. SURFICIAL GEOLOGY

9. The topography at the site is closely controlled by the bedrock which protrudes in numerous and extensive outcrops through the thin overburden. The bedrock is mainly quartz mica schist which trends generally north-south and dips westward at approximately 30° with local variations in dip ranging from 15° to 60°. On the left abutment, because of the structural attitude of the bedrock, the scattered outcrops are inconspicuous and lie essentially parallel to the ground surface as may be seen in photographs of the typical bedrock, Figure 1, so that even the very thin overburden effectively blankets the relatively regular bedrock surface. On the right abutment, however, the bedrock surface exposed in the extensive and generally prominent outcrops is more irregular with abrupt, steep-sided ribs and rounded knobs alternating between narrow troughs and hollows. The overburden in the valley bottom and the lower slopes of the abutments is composed mainly of poorly sorted outwash and alluvial materials. On the higher slopes of the abutments, however, the overburden is mainly very poorly sorted, highly modified, sandy, till-like materials.

E. FOUNDATION CONDITIONS.

10. The overburden throughout practically the entire site, as shown on geological sections, Plates 2-3 to 2-5, is thin and consists of variable, loose to compact, poorly sorted, gravelly sands and sandy gravels with varying amounts of silt and local areas and pockets of cobbles and boulders generally concentrated at or close to the bedrock surface. These materials are relatively pervious to semi-pervious, and in some areas are roughly stratified and lensed.

11. In the valley bottom and on the abutments wherever bedrock is not exposed, the overburden is generally less than 10 feet in thickness. In the valley bottom extending downstream from about the centerline of dam, a narrow, relatively deep trough in the bedrock surface was encountered at boring FD-21. Soil samples from FD-21 composed largely of weathered rock material taken between cored samples of moderately hard, fresh rock indicate that

below a depth of 11 feet the trough is filled largely with boulders or rock blocks to a depth of approximately 26 feet. Other local, shallow troughs or hollows in the bedrock surface were encountered in a few explorations along the valley bottom and downstream side of the right abutment of the dam where overburden occurred to depths up to 18.0 feet.

12. The bedrock, mainly quartz mica schist, is moderately hard and ranges from fine to coarse-grained. In most areas, below the normally weathered upper zone which ranges in thickness from 1 to 5 feet, the rock is fresh except for localized weathering along open foliation planes, joints and closely broken zones. This condition occurs in some of the borings to depths up to 20 feet below the bedrock surface. The mica includes both biotite and sericite generally disseminated but in coarse phases of the schist, it occurs in felted layers parallel to the foliation. The schist is slightly graphitic and also includes scattered thin beds of pods of limestone and stringers of calcite usually associated with quartz veins or granitic zones.

13. The schist trends north-south and has a general westward dip of approximately 30° with local variations in attitude adjacent to granitic areas and granitized zones. Because of this structural attitude, the bedrock surface on the left abutment is relatively smooth and regular but on the right abutment a generally irregular, rough and benched surface must be expected. Joints in the schist and even close-jointing in some of the granitic rocks does not appear to have a consistent pattern or a persistent trend over any considerable area. In boring FD-1 on centerline of dam in the valley bottom, badly brecciated rock was encountered in a fault zone from 26.0 feet to the bottom of the hole at 35.0 feet. Small brecciated zones of 6 inches or less in thickness were also found in borings FD-21 and FD-22.

14. Hydraulic pressure tests in rock which were conducted in some of the borings generally showed only very small losses at pressures up to 30 psi. At a few locations, however, flows of 3 to 5 gpm at 10 psi occurred and it should be noted that at several locations it was impossible to test the upper zones in the rock or to conduct reliable tests because of difficulty in sealing the test equipment in the hole. Because of the badly broken condition of the rock in the brecciated zones, pressure tests were not conducted at boring FD-1. The results and data of all pressure tests are presented in Records of Exploration, Plates 2-6 and 2-7.

F. SUBSURFACE WATER.

15. Subsurface water levels at the site are generally below the rock surface except in the valley bottom where water levels coincide with the stream elevation. Seasonal run-off from the ridges high above the abutments will, of course, be concentrated at the rock surface and may be retained in troughs and gullies in the rock for brief periods.

G. RESERVOIR LEAKAGE.

16. Upstream from the site the sides of the reservoir are very wise, largely till-blanketed, bedrock ridges with crest elevations far above reservoir levels. There is no possibility, therefore, of leakage through the sides of the reservoir.

H. CONSTRUCTION MATERIALS.

17. General - Since the quantities of rock and earth materials from required excavations for this project will be small, the major portion of the dam embankment will be constructed of borrow materials. An impervious borrow area has been established in a large glacial till deposit a short distance upstream from the site. The dam embankment will consist of an essentially homogeneous section of impervious material from this deposit with a small random fill zone in which to utilize material from required earth excavation and rock slope protection layers utilizing material from required rock excavation. Materials for use in gravel bedding layers and the internal drainage features of the embankment will be obtained commercially since there are no sources of these materials in the vicinity of the project which could be developed economically in Government-owned borrow areas.

18. Impervious and Random Material. - Impervious material will be borrowed from the area located immediately upstream and above the left abutment of the dam. The overburden in the area is glacial till which, although characteristically variable, consists mainly of compact, relatively impervious, gravelly, silty and clayey sand with scattered cobbles and boulders. Borings indicate that the material ranges in thickness from 9 feet to more than 75 feet but throughout most of the area the till appears to be from 20 to 35 feet in thickness. The locations of all explorations are shown on Plan of Borrow Explorations, Plate 2-8, and description and classification of materials encountered are shown in Records of Borrow Explorations, Plates 2-9 and 2-10. Material from required excavations at the site, consisting mainly of random type materials, will be utilized in appropriate sections of the embankment.

19. Pervious Materials.- There are no feasibly workable deposits of pervious materials within the reservoir or in the immediate vicinity of the site. Deposits of sands and gravels which occur in the Northfield Brook valley are thin, scattered and very limited in extent. Pervious materials occur in a large area west of Reynolds' Bridge approximately 2 miles south of the site. These deposits have been operated commercially for a long period and,because the operations appear to have been selective, the area is extensively pitted and trenched. It is believed, however, that considerable pervious material is still available in the area and this material could be gleaned for use in pervious sections of the embankment. Several other commercially operated sources of pervious materials are available within 15 miles haul distance of the site.

20. Rockfill.- Rock for fill and slope protection will be available from excavations in rock for the outlet conduit and spillway channel and from boulders in required excavations. The bedrock consists mainly of mica schist with granitic zones and occasional thin limy beds or lenses. The schist is fine-to-coarse-grained, moderately hard, very well-foliated and below the upper, weathered zone is fresh. The well-foliated character of the schist and its tendency to split readily along the mica partings will make much of the rock from excavations slabby and elongate in shape. In granitic phases of the rock, however, the fragment shapes will be more blocky and angular. Although the schist is generally moderately hard, in relatively weak limy zones and in local concentrations of mica, the rock will shatter and break down readily to fine sizes. If the quantity of rock obtained from required excavations is inadequate, additional rock can be quarried from nearby outcropping or shallow bedrock areas within the reservoir.

21. Concrege Aggregates.- It is estimated that approximately 2,000 yards of concrete will be required for construction of spillway weir, walls, and outlet works. Investigations of aggregate materials made in connection with other recent flood control projects in the vicinity indicate that satisfactory materials are available from several commercial sources within 15 mile haul distance. Complete data on testing of concrete aggregates is presented in Design Memorandum No. 5, Concrete Materials, Naugatuck River Basin, dated November 1961.

I. CONCLUSIONS AND RECOMMENDATIONS.

22. Geological conditions at the site and within the reservoir, as disclosed by reconnaissance and foundation explorations, are generally favorable for construction of the proposed dam for retention of both a low permanent pool and a high level flood control impoundment. All geological factors relative to foundations, excavations, leakage and natural borrow materials are being considered in preparation of designs and specifications. Although no major problems concerning engineering geology are anticipated during construction, a digest of the geologic factors involved in design and construction will be prepared for the information and guidance of field construction personnel. The digest will also point out the availability of Division geologists for consultation during construction regarding phases of the work which involve geology.

23. Bedrock is available at relatively shallow depths for cutoff and for foundations at all structure locations. Throughout most of the foundation area, the upper 1 to 5 feet of the bedrock is nominally weathered and is broken by close joints and open foliation planes but below the nominal weathered zone the bedrock is generally satisfactory for foundations for heavy structural loads. A recently completed boring at the location of the conduit intake structure indicates a badly weathered and broken condition to a depth of approximately 20 feet but at foundation grade relatively fresh, hard rock

should be available. The invert of the conduit is well below the rock surface except in the vicinity of boring FD-8 where a broad gully occurs in the rock surface. Local irregularities in the bottom of the rock gully, together with loss of slabby or closely jointed rock during excavation at and immediately below the rock surface, may require excavation to satisfactory foundation below invert grade along a short reach of the alignment. Regardless, however, of whether final rock foundation occurs at or close to grade in this reach, rock will not be available above invert grade on the stream side of the conduit for support of the embankment load. At the spillway the bottom grade of the channel has been established sufficiently deep in rock to maintain adequate free board throughout the discharge channel. In the vicinity of base-line Station 5+40, the small gully shown by the surface topography is underlain by a corresponding depression in the rock surface so that the rock wall on the stream side of the channel is low and could be disturbed and further lowered by blasting and excavation. It is believed, however, that even in this short reach ample freeboard can be maintained.

24. Both conduit and spillway alignments cross the general trend of the bedrock structure at low angles so that excavations will tend to be asymetric with the steeper slope on the down-dip side of the cuts and considerable overbreak behind excavation lines. The effectiveness of line drilling and close drilling in reducing overbreak will vary along the conduit excavation and at structure locations depending not only on the condition of the rock and the attitude of the rock structure but also on the composition of the rock. Where the schist is variably granitized or cut by irregular granitic stringers and dikes and where softer limy pods and lenses occur in the schist, control of breakage within small tolerances cannot be consistently maintained. Line drilling for large areas at structure locations, therefore, is not considered practical.

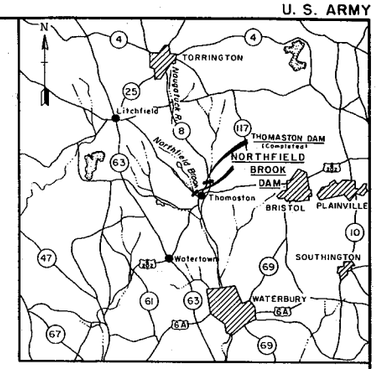
25. Throughout the excavations in rock design slopes of 4 on 1 are considered reasonable. Fallout of slabs and blocks will occur, however, particularly on the up-dip side of excavations wherever locally graphitic and felted micaceous rocks with smooth foliation planes are intersected by close jointing behind the excavation face. It will also be necessary to roll back the excavation slopes along the crest of the deeper cuts to avoid fallout of loose blocks from the 1 to 5 foot thick upper weathered zone in the rock. The overburden will be cleaned off in a zone 10 feet wide along the top of excavations in rock to permit inspection of the rock surfaces for possible detection of incipient slides and prevention of fallouts of boulders and loose blocks. Although the rock cuts are generally less than 40 feet in depth, rock cuts on the uphill side of the spillway discharge channel as presently planned, will be up to 55 feet in depth. Chain link wire safety mesh will be provided for cut slopes in rock where the rock structure or condition indicates possible hazard from rock falls. Rock bolts will be utilized where necessary and feasible to stabilize rock slopes. Anchors will be inclined to engage the maximum quantity of sound rock.

26. Bedrock is available at shallow depths for impervious cutoff in the embankment foundation. Seepage can occur through the nominally weathered and broken upper zone in the rock which, although it does not occur continuously throughout the foundation area, is sufficiently prevalent to be considered a general condition for design purposes. The zone ranges generally from 1 to 5 feet in thickness but locally may be up to 8 feet thick. Below the upper zone of weathering, seepage can also occur along open seams, mainly weathered joints and foliation planes, which occur in the bedrock to depths of more than 20 feet below the rock surface. The fault zone encountered at boring FD-1 and the smaller brecciated slippage planes which were found at borings FD-21 and FD-22 also indicate the occurrence of possible seepage paths through the foundation rock. Hydraulic pressure tests in rock which were conducted at most of the borings along the centerline of dam and the initial conduit alignment show that significant water losses occurred at a few locations. In view of the general structural alignment of the bedrock in relation to the axis of the dam and the overall condition of the rock, a grout curtain will be required at the concrete weir, outlet conduit and in the cutoff trench for embankment foundation at least up to Elevation 500 m.s.l. which is the level of the permanent pool. The necessity for grouting to the full height of the flood control pool at Elevation 586 will be determined after completion of design studies for the embankment.

27. Rock from rock excavation and boulders from required excavations will be suitable for use in slope protection and rockfill on the embankment. Particle shapes will tend to be slabby and elongate in the predominantly schistose rocks but where granitic rocks and granitized phases of the schists are encountered, more angular and blocky shapes will be obtained. Breakdown of the rock in relatively soft limy zones and mica concentrations during blasting and handling is expected to produce a relatively large proportion of undesirable fines. It is estimated that the excavated rock will increase in volume by a factor of approximately 1.3 over insitu volume but breakdown and other losses are expected to considerably reduce the bulking. No unusual difficulty is expected in excavation of the till in the impervious borrow area. Ground water levels are indicated to be close to the ground surface in some of the observation wells installed in borings but relief in the area is sufficient so that adequate drainage can be provided readily.

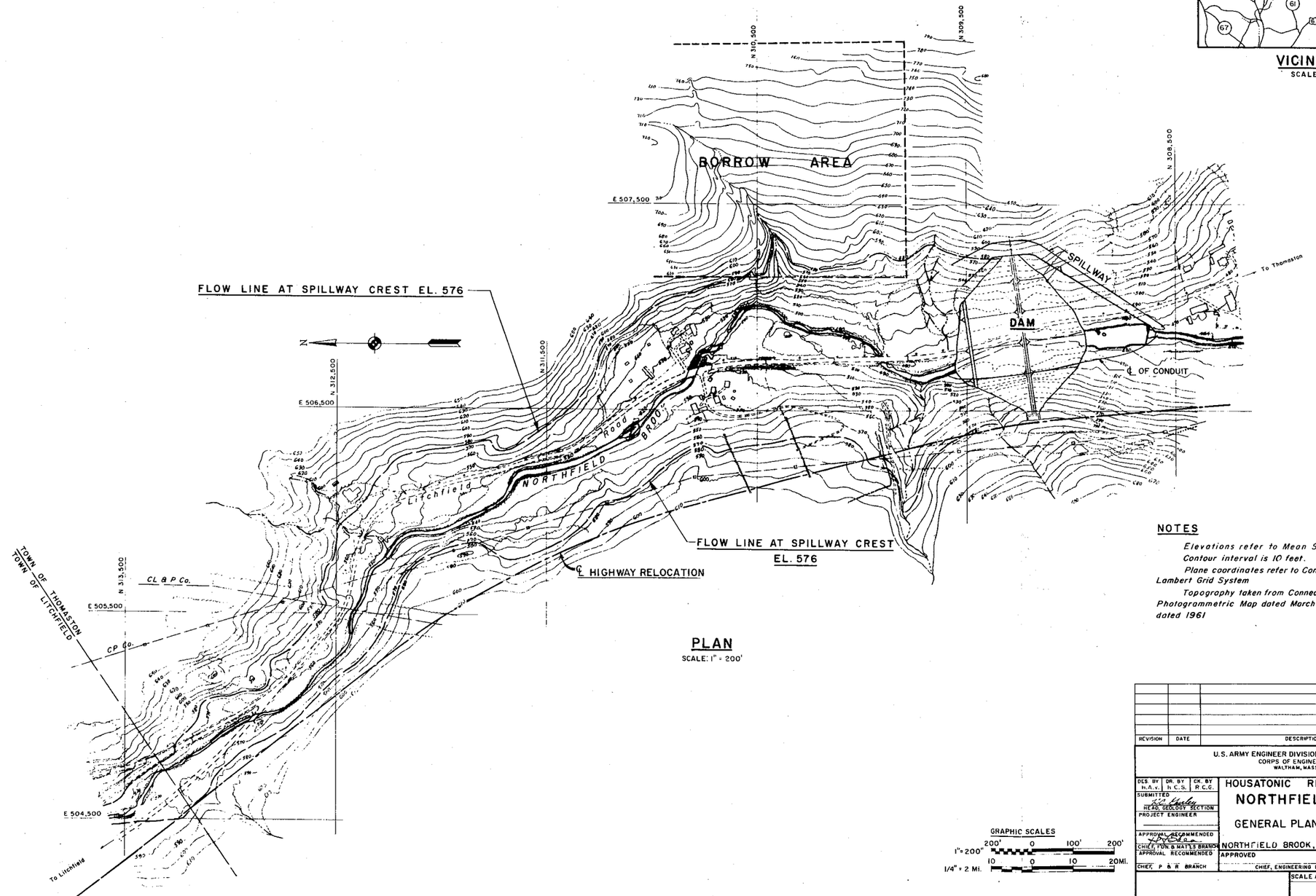
CORPS OF ENGINEERS

U. S. ARMY



VICINITY MAP

SCALE: 1/4" = 1 Mile



PLAN

SCALE: 1" = 200'

GRAPHIC SCALES

1" = 200' 200' 0 100' 200'

1/4" = 2 Mi. 10 0 10 20MI.

NOTES

Elevations refer to Mean Sea Level Datum.
Contour interval is 10 feet.
Plane coordinates refer to Connecticut State Lambert Grid System
Topography taken from Connecticut State Highway Photogrammetric Map dated March 1951 and NED survey dated 1961

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	H.C.S.	R.C.G.

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APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

HOUSATONIC RIVER FLOOD CONTROL

NORTHFIELD BROOK DAM

GENERAL PLAN AND RESERVOIR MAP

NORTHFIELD BROOK, CONNECTICUT

APPROVED DATE APRIL 1962
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC NO. CIV. ENG. -19-016-
DRAWING NUMBER

SHEET OF

PLATE NO. 2-1

CORPS OF ENGINEERS

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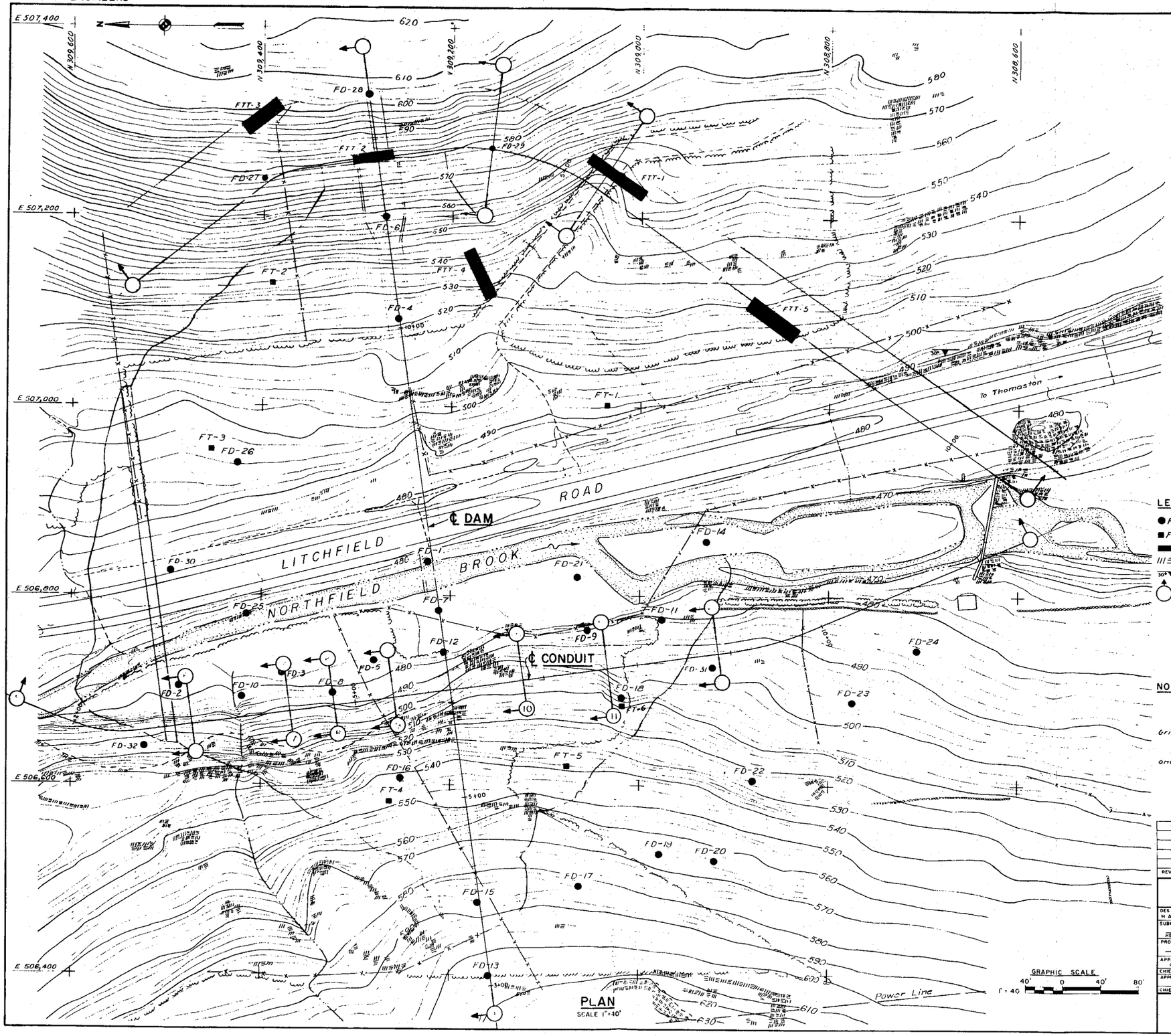

PLAN
SCALE 1"=40'

LEGEND

- ● FD Foundation Test Boring
- ■ FT Foundation Test Pit
- ▬ FTT Foundation Test Trench (Power excavated)
- Bedrock Outcrop
- Strike and Dip of Foliation
- Location and direction of view for Gelogic Log Section

NOTES

Elevations refer to Mean Sea Level Datum

Contour interval is 2 feet

Plane Coordinates refer to Connecticut State Lambert Grid System

For Record of Foundation Explorations, see Plate Nos. 2-6 and 2-7

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	H.C.S.	K.C.G.

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Chief, Geology Section
HEAD, GEOLOGY SECTION
PROJECT ENGINEER

APPROVAL RECOMMENDED
CHIEF, FDN. & MAT'LS BRANCH

APPROVAL RECOMMENDED
CHIEF, P.B.H. BRANCH

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
PLAN OF FOUNDATION EXPLORATIONS
NORTHFIELD BROOK CONNECTICUT

APPROVED
CHIEF, ENGINEERING DIVISION
DATE APRIL 1962

SCALE AS SHOWN | SPEC NO. CIV. ENG. -19-016-
DRAWING NUMBER
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PLATE NO. 2-2

CORPS OF ENGINEERS

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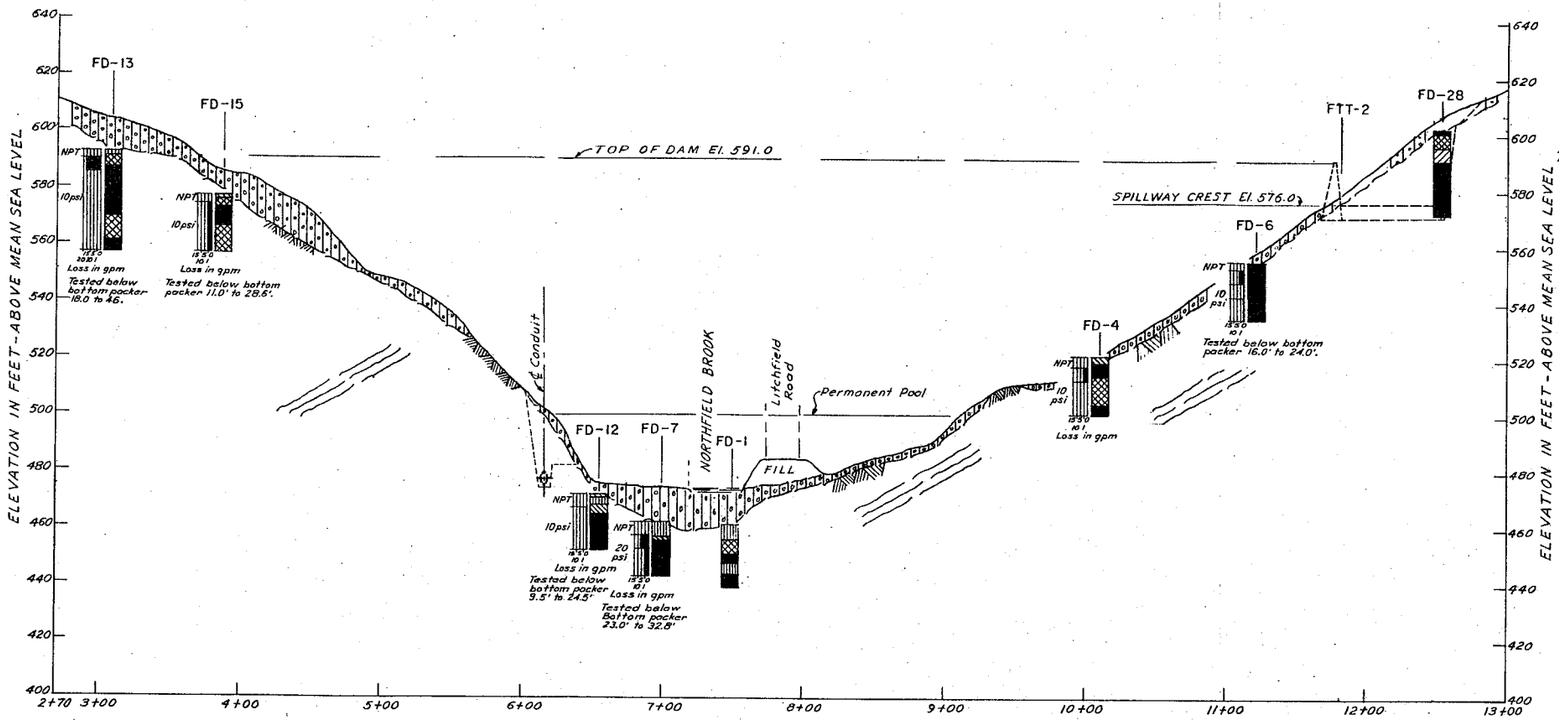

SECTION 1 - 1 ℄ DAM
(LOOKING UPSTREAM)

LEGEND

Overburden - Variable gravelly, silty sands and silty sands and gravels with cobbles and boulders. Also includes scattered thin areas of decomposed rock.

Assumed Bedrock Surface
Bedrock consists mainly of quartz mica SCHIST partly granitized locally with scattered areas of granitic rocks.

General dip of foliation of bedrock. Local variations in dip range from 20° to 70°.

NOTES

See Legend for Graphic Logs for symbols and notes applicable to core borings in rock, Plate No. 2-6.
For location of Section, see Plate No. 2-2.
For Record of Foundation Explorations, see Plate Nos. 2-6 and 2-7.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.Y.	DR. BY R.D.B.	CK. BY R.C.G.

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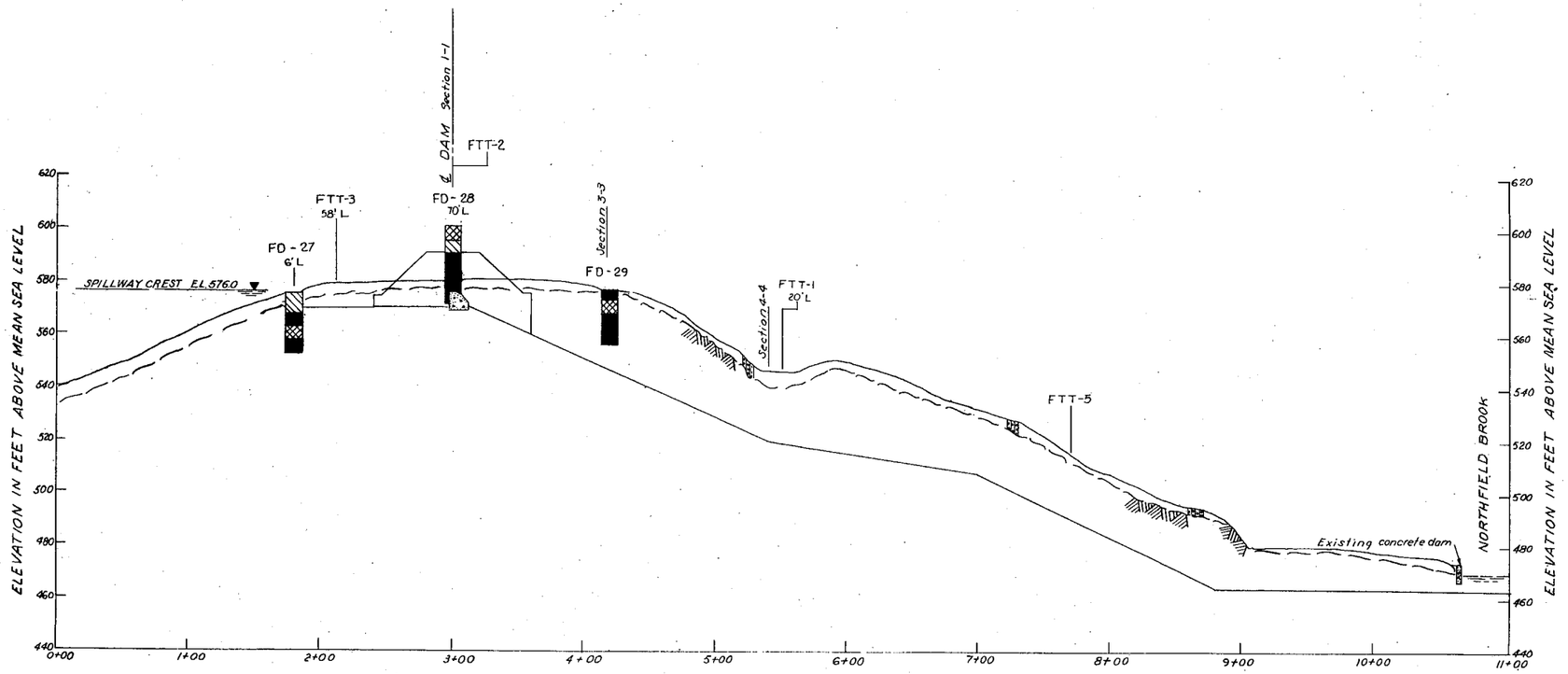
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

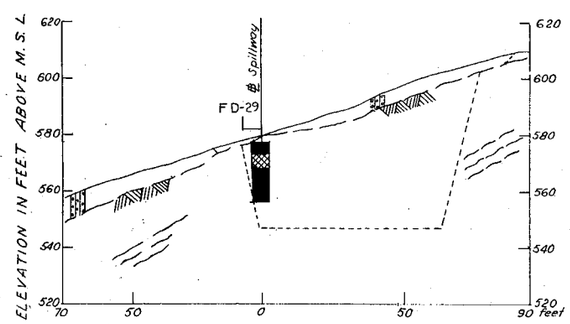
HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
DAM
GEOLOGIC-LOG SECTION
NORTHFIELD BROOK, CONNECTICUT
APPROVED
CHIEF, ENGINEERING DIVISION
DATE APRIL 1962

SCALE: AS SHOWN SPEC. NO. CIV. ENG. - 19 - 016 -
DRAWING NUMBER
SHEET

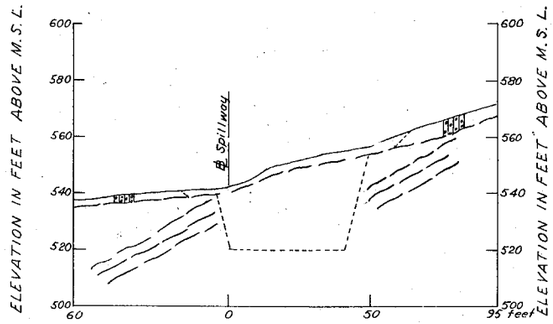
PLATE NO. 2-3



SECTION 2-2 ℄ SPILLWAY
LOOKING EAST



SECTION 3-3 STA. 4+20
(LOOKING UPSTREAM)



SECTION 4-4 STA. 5+40
LOOKING UPSTREAM)

NOTES

For Legend for Geologic Sections and applicable notes, see Plate No. 2-3.

See Legend for Graphic Logs for symbols and notes applicable to core borings in rock. Plate No. 2-6

For location of Sections see Plate No. 2-2

For Record of Foundation Explorations, see Plate Nos. 2-6 and 2-7.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY N.A.V	DR. BY R.A.W.	CH. BY R.C.G.
SUBMITTED		
PROJECT ENGINEER		
APPROVAL RECOMMENDED		
CHIEF, FOUNDATIONS BRANCH		
APPROVAL RECOMMENDED		
CHIEF, P & S BRANCH		

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
SPILLWAY
GEOLOGIC-LOG SECTIONS

NORTHFIELD BROOK, CONNECTICUT

APPROVED
CHIEF, ENGINEERING DIVISION

DATE APRIL 1962

SCALE AS SHOWN SPEC. NO CIV. ENG.-19-016

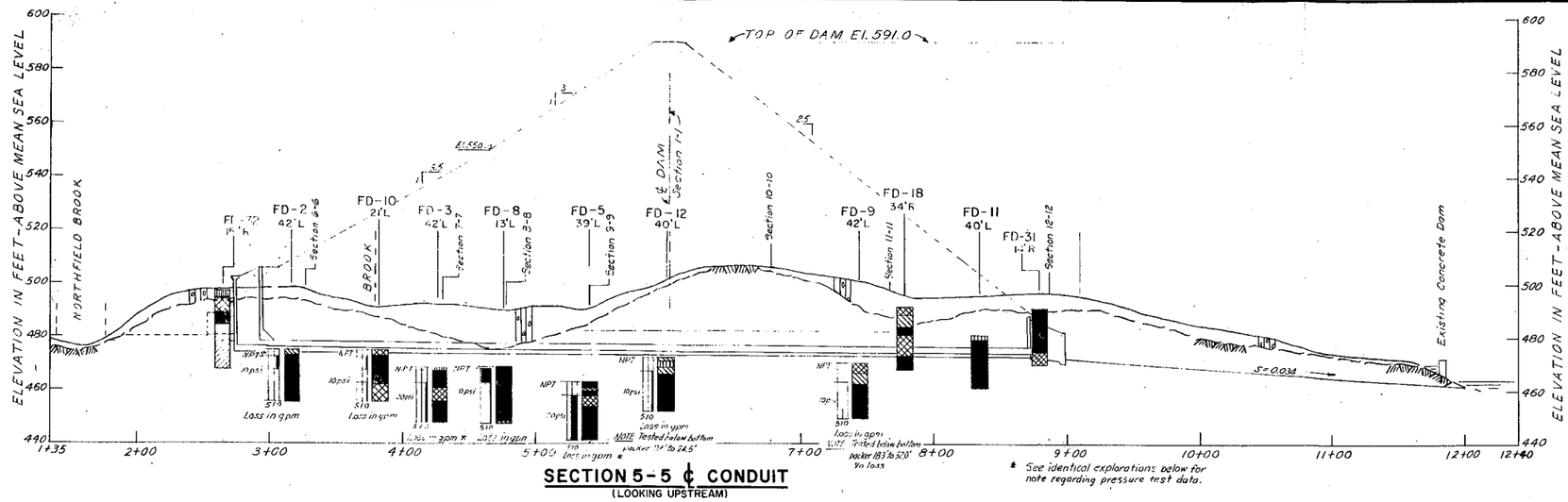
DRAWING NUMBER

SHEET

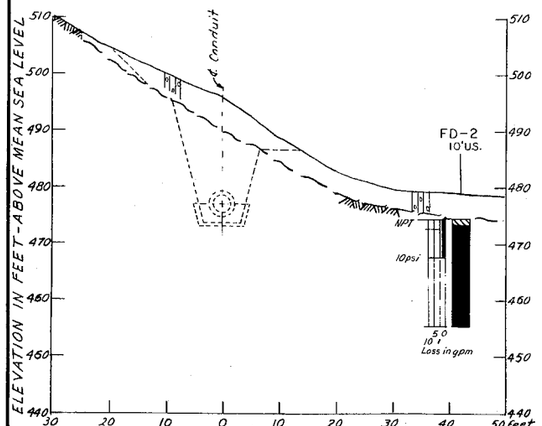
PLATE NO. 2-4

CORPS OF ENGINEERS

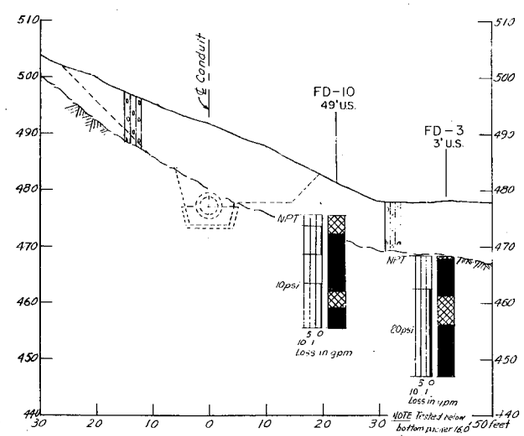
U.S. ARMY



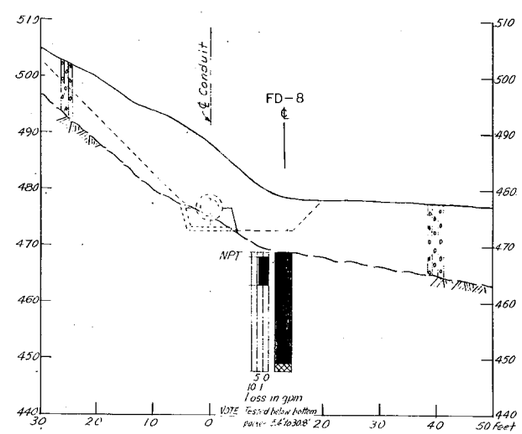
SECTION 5-5 ℄ CONDUIT
(LOOKING UPSTREAM)



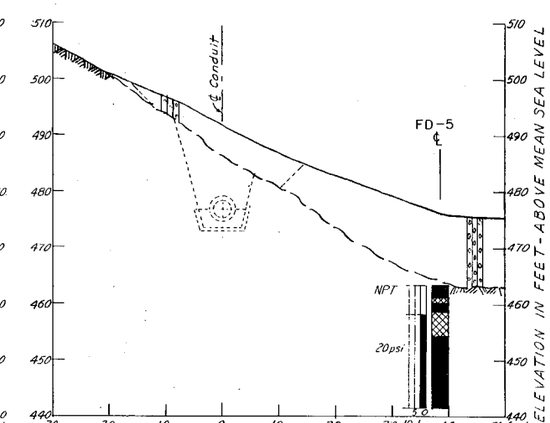
SECTION 6-6 STA. 3 + 27
(LOOKING UPSTREAM)



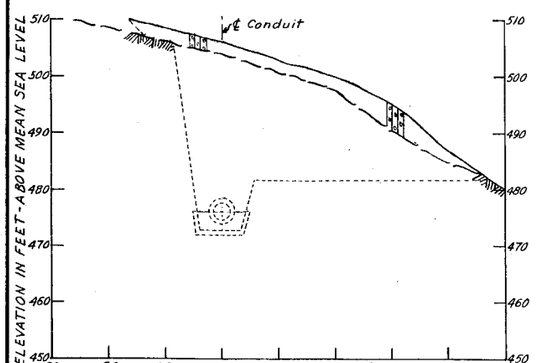
SECTION 7-7 STA. 4 + 30
(LOOKING UPSTREAM)



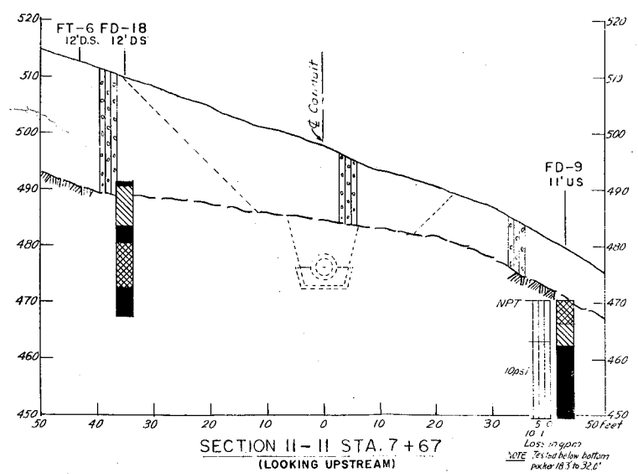
SECTION 8-8 STA. 4 + 77
(LOOKING UPSTREAM)



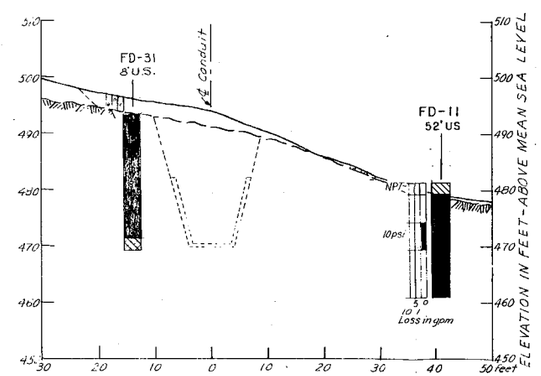
SECTION 9-9 STA. 5 + 41
(LOOKING UPSTREAM)



SECTION 10-10 STA. 6 + 77
(LOOKING UPSTREAM)



SECTION 11-11 STA. 7 + 67
(LOOKING UPSTREAM)



SECTION 12-12 STA. 8 + 86
(LOOKING UPSTREAM)

NOTES

For Legend for Geologic Sections and applicable notes, see Plate No. 2-3.

See Legend for Graphic Logs for symbols and notes applicable to core borings in rock Plate No 2-6.

For location of Sections see Plate No 2-2

For Record of Foundation Explorations, see Plate Nos 2-6 and 2-7.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	R.A.W.	R.C.G.

SUBMITTED
HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, P,D,N & MAT'LS BRANCH
APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
OUTLET CONDUIT
GEOLOGIC-LOG SECTIONS

NORTHFIELD BROOK, CONNECTICUT

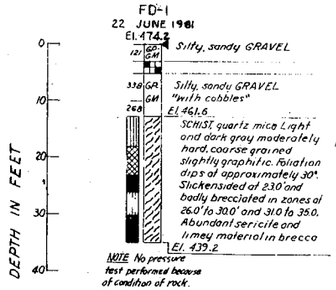
APPROVED
CHIEF, ENGINEERING DIVISION
DATE APRIL 1962

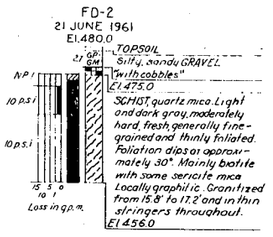
SCALE: AS SHOWN
SPEC NO. CIV. ENG.-19-016-
DRAWING NUMBER
SHEET

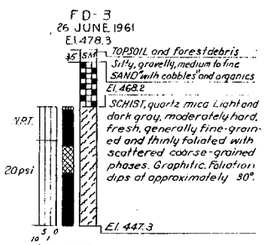
PLATE NO. 2-5

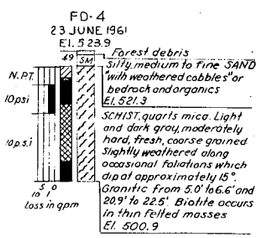
CORPS OF ENGINEERS

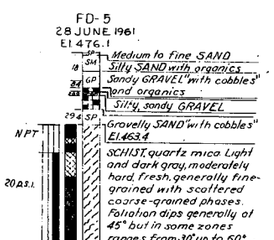
U. S. ARMY

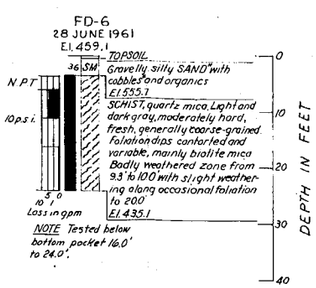


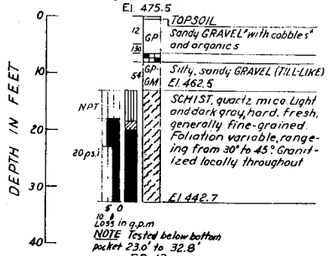


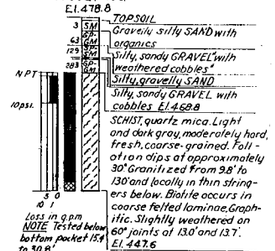


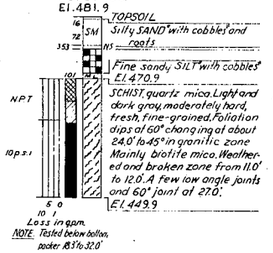


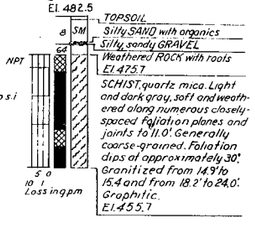


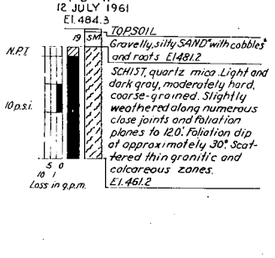


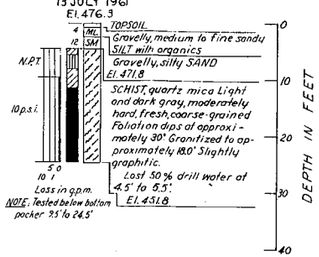


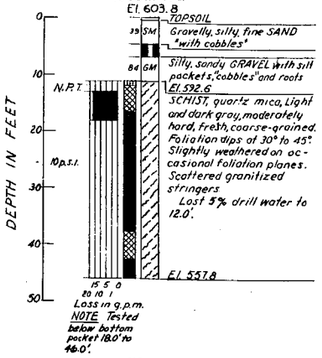


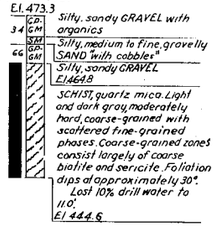


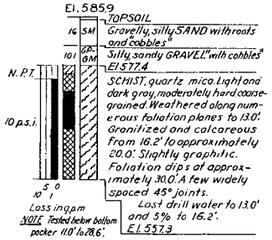


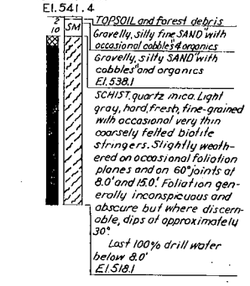


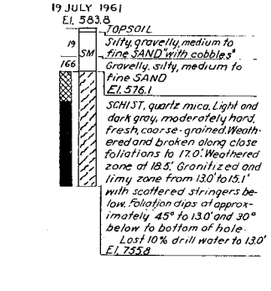


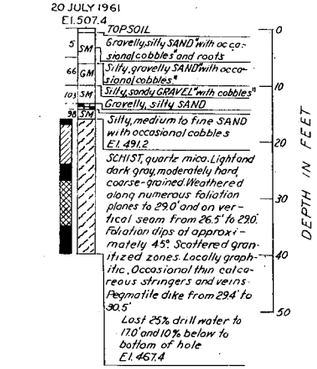


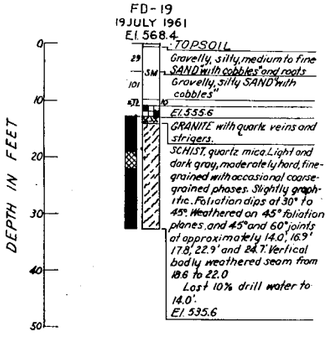


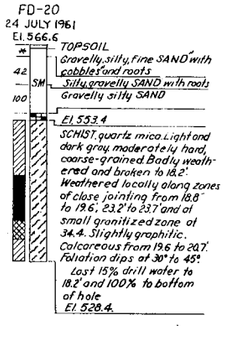


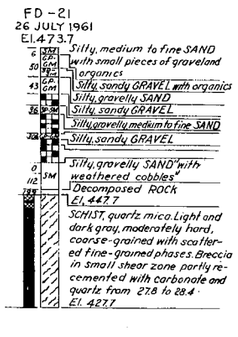


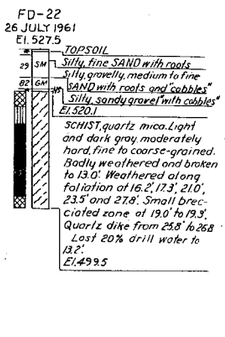


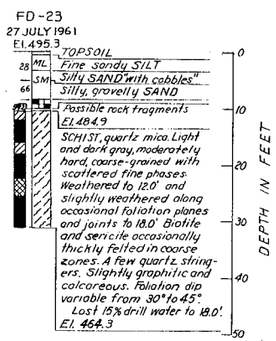












LEGEND FOR GRAPHIC LOGS

FD Foundation Test Boring
FT Foundation Test Pit
BD Borrow Test Boring
BT Borrow Test Pit

(OW) Observation well installed
12 JULY 1961 Date exploration completed
El. 482.5 Elevation of ground surface during time of exploration

Maximum artesian head
Subsurface water level in boring at time of exploration.
Range of subsurface water during period of observation.

Artesian flow encountered
Group letter symbol according to United Soil Classification System
NR No Recovery or unsatisfactory soil samples recovered.
NS Not Sampled. Hole advanced by Core-drilling, blasting and/or wash boring due to operational difficulty.
Bottom of observation well.
Sampling in overburden by Core-drilled method
Blows per foot of penetration considered most representative for each sample drive using a 300 or 350 pound hammer with a free fall of about 18" on a 1⅜" I.D. or 2" O.D., 2"I.D. or 2½" O.D. and/or 2½" I.D. or 3" O.D. size sample spoon equipped with a beveled and sharpened drive shoe.
Blow counts not recorded or not considered representative
Cobble or boulder (Core-drilled)
Cobbles or boulders, continuous or nested (Core-drilled and/or blasted and chopped)
El. 475.7 Elevation of bedrock surface
Rock symbol
El. 455.7 Elevation bottom of exploration

Rock core recovery 0 - 25 %
Rock core recovery 25 - 50 %
Rock core recovery 50 - 75 %
Rock core recovery 75 - 90 %
Rock core recovery 90 - 100 %

Loss in gpm
N.P.T No Pressure Test Performed. Asterisk denotes that section could not be sealed for testing
10 psi Constantly maintained pressure for 1 to 5 minutes
Volume loss in gallons per minute under constant pressure, tested continuously in 5-foot sections
Scale expanded from 0 gpm to 10 gpm for clarification of low flow losses.

Water levels recorded during subsurface explorations seldom correspond with the natural level of free ground water, except in extensive and thick deposits of sands and gravels which are sufficiently pervious to permit rapid stabilization of water levels in the exploratory hole. Absence of subsurface water level in the graphic log of any exploration is not necessarily to be construed that ground water will not be encountered in excavation at that location

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations characteristic of the overburden and rocks of this region are anticipated, and if encountered, such variations will not be considered as differing "Materially" from represented conditions within the purview of Article 4 of the Contract.

NOTES

Elevations refer to Mean Sea Level Datum
For Location of Foundation Explorations, see Plate No. 2-2

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CH. BY
H.A.V.	R.A.W.	R.C.G.

SUBMITTED
HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, FDN & MATLS BRANCH
APPROVAL RECOMMENDED
CHIEF, F & R BRANCH

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
RECORD OF FOUNDATION EXPLORATIONS NO. 1

NORTHFIELD BROOK, CONNECTICUT

APPROVED
CHIEF, ENGINEERING DIVISION
DATE APRIL 1962

SCALE
DRAWING NUMBER
SHEET

PLATE NO. 2-6

CORPS OF ENGINEERS

U. S. ARMY

DEPTH IN FEET

FD-24
28 JULY 1961
El. 484.9
- 0 – 3.8: SM — TOPSOIL; Silty, gravelly SAND with roots
- 3.8 – 18.0: SM — Silty SAND with weathered rock fragments
- 18.0 – 40.0: Weathered ROCK with sand
- El. 479.2

SCHIST, quartz mica, Light and dark gray, moderately hard, fine to coarse-grained phases. Weathered to 10' and along open fracture zones at 9.0', 10.2', 11.2', 12.4', 22.2' and 23.1'. Felted biotite and sericite occur adjacent to occasional thin quartz stringers. Foliation dips at approximately 30°.
Lost 15% water to 70' and El. 458.9 5% to 14.0'

FD-25
27 JULY 1961
El. 473.0
- 0 – 18.0: SCHIST, quartz mica, Light and dark gray, moderately hard, mainly coarse-grained with scattered fine-grained phases. Slightly weathered along foliation planes and joints to 4.3'. Slightly graphitic. Pegmatite from 6.6' to 24.0'. Foliation dips at approximately 30° Calcareous adjacent to pegmatite zone. Foliation dips generally at approximately 30°.
- 18.0 – 40.0: Lost 15% drill water to 4.3'
- El. 449.2

FD-26
1 AUG 1961
El. 494.5
- 0 – 10: SM — TOPSOIL; Fine sandy organic SILT
- 10 – 45: GM — Silty, medium to fine SAND with organics
- 45 – 58: SM — Silty, gravelly GRAVEL with cobbles and SAND
- El. 437.0

SCHIST, quartz mica, Light and dark gray, moderately hard, fresh, coarse-grained with scattered fine phases. Felted biotite occurs in coarse zones. Granitized from 18.3' to 13.5'. Slightly weathered on occasional foliation planes and joints to 17.0'. Foliation dips of approximately 30°.
Lost 10% drill water below 75'.
El. 468.5

FD-27
28 FEB 1962
El. 579.5
- 0 – 18: SM — TOPSOIL with roots; Silty, gravelly SAND with roots and cobbles
- 18 – 40: Weathered ROCK fragments and decomposed rock
- El. 575.8

SCHIST, quartz mica, Light and dark gray, moderately hard, fine to coarse grained. Partly granitized below approximately 13.0'. Weathered along numerous closely-spaced foliation planes to 15.0' and on scattered foliation planes and joints to approximately 24.0'. Foliation dip variable from 30° to 60°.
Lost 15% drill water to 6.9', 10% loss to 21.9', 5% loss to bottom of hole.
El. 552.8

FD-28
5 MAR 1962
El. 607.2
- 0 – 6: WC&M — TOPSOIL and forest debris
- 6 – 40: SM — Sandy SILT with roots
- Gravelly, silty, medium to fine SAND with weathered rock fragments
- Decomposed ROCK and weathered rock fragments
- El. 602.6

SCHIST, quartz mica, Light and dark gray, moderately hard, generally coarse-grained. Badly weathered schist between granite stringers to 10.8'. Weathered along scattered foliation planes and joints below 10.8' to bottom of hole. Quartzitic zones scattered throughout. Slickensided joint at 32.0'. Foliation dip variable and contorted but generally steep.
Lost 5% drill water throughout
El. 572.2

FD-29
8 MAR. 1962
El. 508.2
- 0 – 2: WC&M — TOPSOIL and forest debris
- 2 – 10: SM — Gravelly, silty, medium to fine SAND with roots
- Decomposed ROCK and weathered rock fragments
- NS
- El. 577.2

SCHIST, quartz mica, Light and dark gray, moderately hard, fine and coarse-grained. Weathered along numerous foliation planes in coarse biotite schist to approximately 13.0'. Weathered along occasional foliation planes below 13.0' to bottom of hole. Weathered seam on 45° joint at approximately 19.0'. Foliation dips of approximately 30°.
Lost 10% drill water to 6.9', 5% loss below to bottom of hole.
El. 557.0

FD-30
14 FEB. 1962
El. 464.6
- 0 – 14: WC&M — Silty, sandy Gravel with cobbles and roots (FILL)
- 14 – 23: SM — Fine sandy SILT
- 23 – 33: GM — Silty, gravelly SAND with cobbles and weathered rock fragments
- 33 – 40: Silty, sandy GRAVEL
- Decomposed ROCK and rock fragments
- NS
- El. 476.0

SCHIST quartz, mica, Light and dark gray, moderately hard, fine to coarse grained. Soft and weathered in coarse mica zone, to approximately 11.0' and slightly weathered on occasional foliation planes to bottom of hole. Scattered slightly calcareous zones. Foliation dips at approximately 30°.
Lost 5% drill water throughout.
El. 455.2

DEPTH IN FEET

FD-31
16 MAR 1962
El. 496.4
- 0 – 18: SM — TOPSOIL with roots; Gravelly, silty, medium to fine SAND with roots
- 18 – 89: Decomposed ROCK and weathered rock fragments
- El. 490.6

SCHIST, quartz mica, Light gray, hard, fresh generally finer grained with scattered coarse-grained phases. Slight weathering on occasional foliation planes. Small cavity in quartz dike at 21.0'. Foliation dips at 30° to 45°.
Lost 5% drill water throughout.
El. 469.4

FD-32
21 MAR 1962
El. 499.0
- 0 – 5: SM — TOPSOIL and forest debris; Silty medium to fine SAND (micaceous) with roots and weathered rock fragments
- 5 – 40: Weathered ROCK
- El. 494.2

SCHIST, quartz mica, Light and dark gray, moderately hard, fine to coarse-grained. Weathered along numerous foliation planes from 3.8' to 6.6' and on more scattered foliations to 16.2'. Weathered zones from 16.5' to 16.8', 17.7' to 20.1', and 21.7' to 23.5'. Small cavities in recemented zone from 23.0' to 23.8'. Quartzite from 25.0' to 29.0'. Foliation dips wrinkle and contorted ranging from 30° to 60°.
Lost 5% drill water to 22.3' and 100% below to bottom of hole
El. 469.2

DEPTH IN FEET

FT-1
22 JUNE 1961
El.
- 0 – 3: SM — Loose, TOPSOIL
- 3 – 7: SM — Loose, gravelly, medium to fine SAND with trace of roots
- 7 – 10: GM — Compact, silty, sandy GRAVEL

PIT DIMENSIONS 6.0'x 2.5'x 3.0' to 4.5'
Cobbles and Boulders
4" - 6" 29
6" - 18" 4

FT-2
23 JUNE 1961
El.
- 0 – 3: SM — Loose TOPSOIL "with cobbles"
- 3 – 10: Loose, gravelly, silty SAND with roots

PIT DIMENSIONS 5.5' x 2.5' x 1.7' to 2.5'
Cobbles and Boulders
4" - 6" 5
6" - 18" 1

FT-3
23 JUNE 1961
El.
- 0 – 3: SM — TOPSOIL
- 3 – 10: GP — Compact, silty, medium to fine SAND (stratified)
- Compact, sandy GRavel "with many cobbles"

PIT DIMENSIONS
Cobbles and Boulders
4" - 6" 58
6" - 18" 33
Over 18" 9

FT-4
26 JUNE 1961
El. 548.4
- 0 – 3: SM — Loose TOPSOIL with roots
- 3 – 8: SM — Loose, silty, gravelly SAND with roots "cobbles and boulders"
- 8 – 10: SM — Compact, silty, gravelly SAND with cobbles and boulders, trace of mica
- Compact silty, gravelly SAND "with boulders"

PIT DIMENSIONS 6.0' x 3.0' x 8.0'
Cobbles and Boulders
4" - 6" 27
6" - 18" 29
Over 18" 5

FT-5
26 JUNE 1961
El. 537.9
- 0 – 3: SM — Loose TOPSOIL with roots
- 3 – 8: SP-SM — Loose, fine SAND with roots "cobbles and boulders"
- 8 – 10: SM — Med. compact, silty, gravelly SAND "with cobbles, boulders" and mica
- Decumposed Rock

PIT DIMENSIONS 6.0' x 3.0' x 7.5'
Cobbles and Boulders
4" - 6" 8
6" - 18" 7
Over 18" 2

FT-6
26 JUNE 1961
El. 512.0
- 0 – 3: SM — Loose, TOPSOIL with roots
- 3 – 8: SP-SM — Loose, gravelly, silty, medium to fine SAND with roots, "cobbles and boulders"
- 8 – 10: SM — Med. compact, silty, gravelly SAND "with cobbles, boulders" and mica

PIT DIMENSIONS 6.0' x 3.0' x 7.5'
Cobbles and Boulders
4" - 6" 12
6" - 18" 12
Over 18" 4

DEPTH IN FEET

NOTES

Elevations refer to Mean Sea Level Datum.

For Location of Foundation Explorations, see Plate No. 2-2

For Legend of Graphic Logs and applicable notes, see Plate No. 2-6

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	R.A.W.	R.C.G.

SUBMITTED: CHIEF, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED: CHIEF, PLANNING BRANCH
APPROVAL RECOMMENDED: CHIEF, P & R. BRANCH

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
RECORD OF FOUNDATION EXPLORATIONS NO. 2

NORTHFIELD BROOK, CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION
DATE APRIL 1962

SCALE
DRAWING NUMBER
SHEET

PLATE NO. 2-7

CORPS OF ENGINEERS

U. S. ARMY

PLAN

SCALE 1" = 80'

GRAPHIC SCALE

1" = 80' 80' 0 80' 160'

LEGEND

- ● BD *Borrow Test Boring*
- ■ BT *Borrow Test Pit*
- ///≡/// *Bedrock Outcrop*

NOTES

Elevations refer to Meon Sea Level Datum.

Contour interval is 5 feet.

Plane Coordinates refer to Connecticut State Lambert Grid System.

For Record of Borrow Explorations see Plates 2-9 and 2-10

For general location of Borrow Area see Plate 2-1

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.A.V.	DR. BY H.C.S.	CK. BY R.C.G.
SUBMITTED HEAD, GEOLOGY SECTION		
PROJECT ENGINEER		
APPROVAL RECOMMENDED CHIEF, FDN & MAT'L BRANCH		
APPROVAL RECOMMENDED CHIEF, P & R BRANCH		

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
PLAN OF BORROW EXPLORATIONS

NORTHFIELD BROOK, CONNECTICUT

APPROVED DATE APRIL 1962

CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC. NO. CIV. ENG.-19-016-

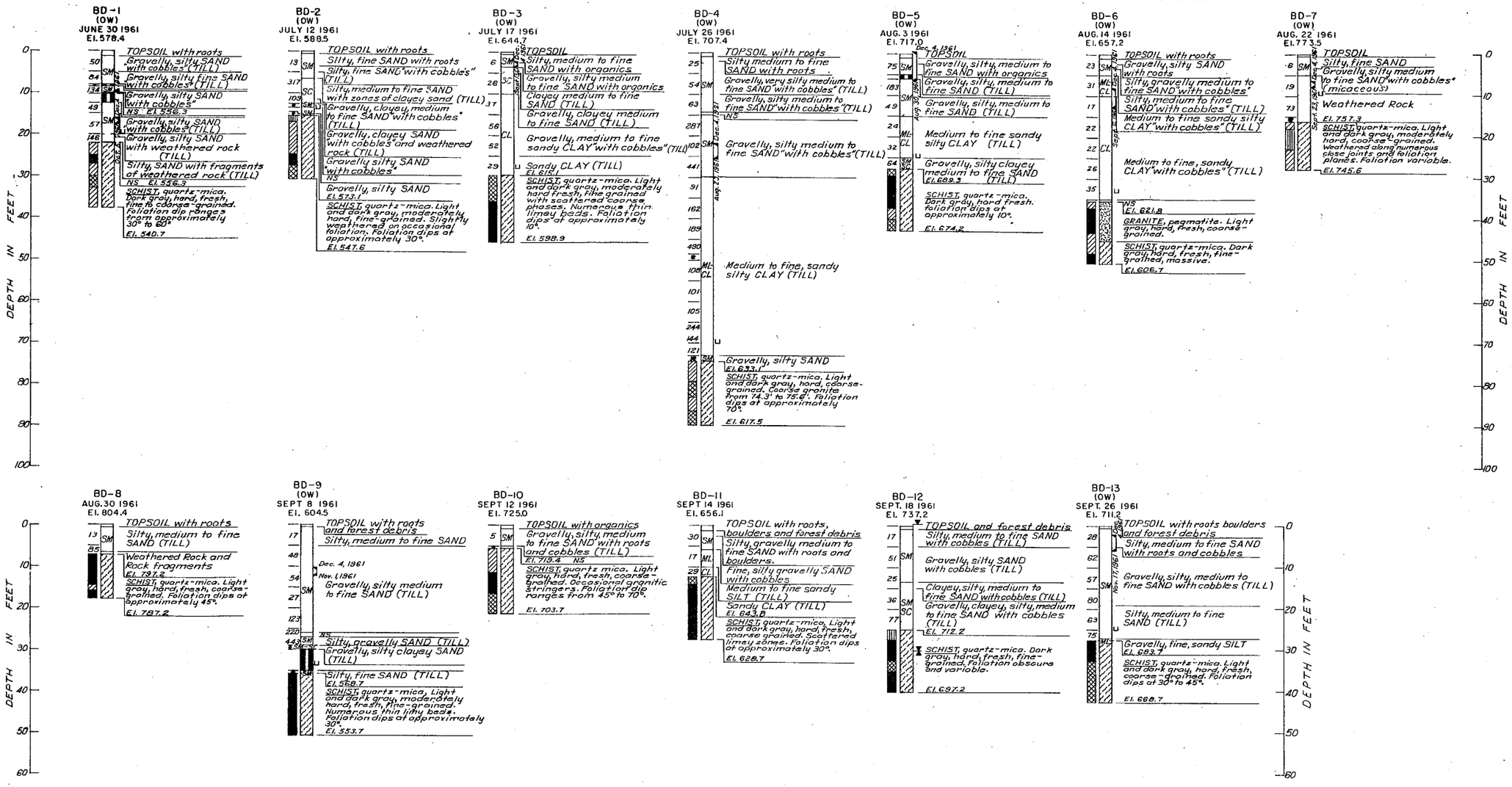
DRAWING NUMBER

SHEET

PLATE NO. 2-8

CORPS OF ENGINEERS

U. S. ARMY



NOTES

Elevations refer to Mean Sea Level Datum

For location of Borrow Explorations, see Plate No. 2-8

For Legend of Graphic Logs and applicable notes see Plate No. 2-6

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	R.D.B.	R.C.G.

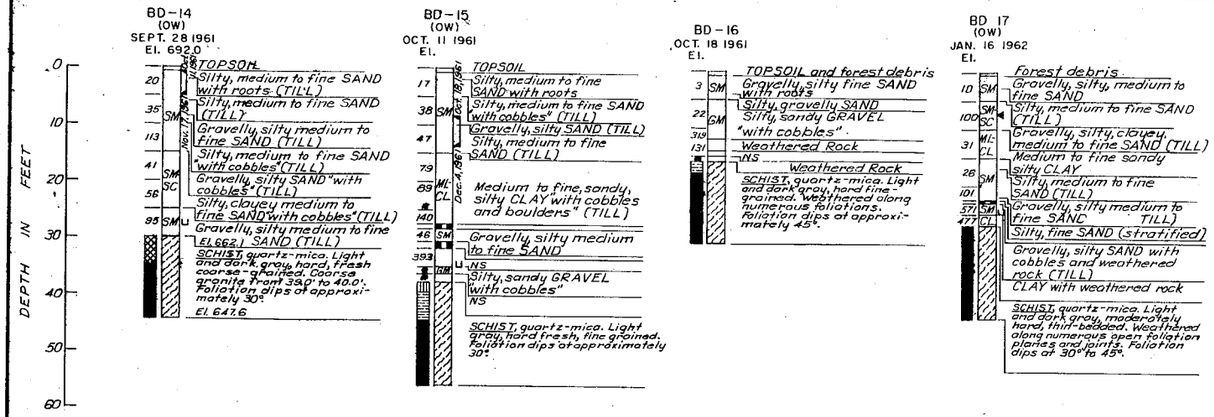
SUBMITTED
H.C. Bailey
HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, FDN & MATLS BRANCH
APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

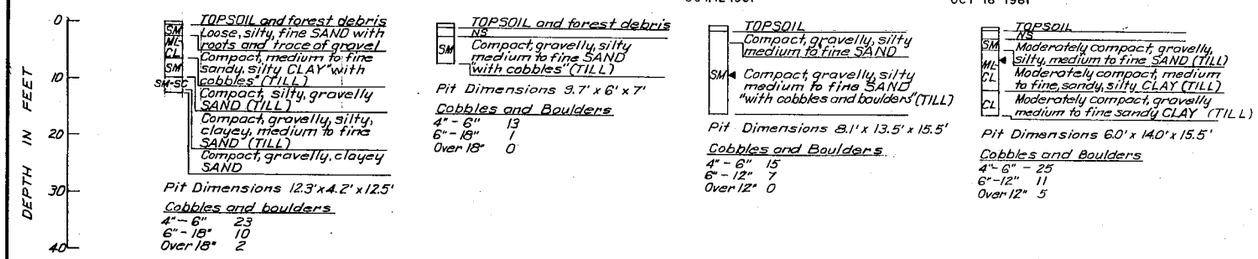
HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
RECORD OF BORROW EXPLORATIONS
NO. 1
NORTHFIELD BROOK, CONNECTICUT
APPROVED
DATE APRIL 1962
CHIEF, ENGINEERING DIVISION
SCALE AS SHOWN
SPEC. NO. CIV. ENG.-19-016-
DRAWING NUMBER
SHEET OF

PLATE NO. 2-9

CORPS OF ENGINEERS

U. S. ARMY





NOTES

Elevations refer to Mean Sea Level Datum

For Location of Borrow Explorations, see Plate No. 2-8

For Legend of Graphic Logs and applicable notes, see Plate No. 2-6

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
H.A.V.	R.D.B.	R.C.G.

SUBMITTED
H.A. Vaughan
HEAD, GEOLOGY SECTION
PROJECT ENGINEER

APPROVAL RECOMMENDED
CHIEF, FOUN & MATLS BRANCH
APPROVAL RECOMMENDED
CHIEF, P & R BRANCH

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
RECORD OF BORROW EXPLORATIONS
NO. 2

NORTHFIELD BROOK, CONNECTICUT

APPROVED
CHIEF, ENGINEERING DIVISION

DATE APRIL 1962

SCALE AS SHOWN SPEC. NO. CIV. ENG - 19-016-
DRAWING NUMBER
SHEET OF

PLATE NO. 2-10